

FEEDING HABITS OF ADULT SHAD (*ALOSA SAPIDISSIMA*) IN FRESH WATER¹

The American shad (*Alosa sapidissima*) is an anadromous fish that upon maturity enters streams along the Atlantic and Pacific coasts each spring and early summer to spawn. It has been the common belief of previous workers that the shad do not feed to any extent while in fresh water, accounting for the progressive decrease in fat content during their fresh water stay, the formation of spawning marks on the scales, and if their stay is prolonged, a possible cause of mortality. Leim (1924) summing up the opinions of early writers, as well as his own observations, states that "shad did not feed actively (in fresh water), but only took such things as came their way." Leach (1925) says that "after entering the rivers the shad takes but little, if any, food previous to spawning but after casting its eggs, it bites at flies or any small shining object, and has been known to take the artificial fly." Moss (1946) notes that "It is believed that adult shad eat but very little or not at all while in fresh water." Consequently, I was rather surprised when adult, unspawned shad recently placed in a fresh water pond at the U. S. Fishery Laboratory, Beaufort, North Carolina (Sykes 1951) began actively to take a diet of ground fish as well as a liver - fish meal mix.

A total of seventeen adult shad (ten males, seven females) were placed in a fresh water pond about sixty feet square and with the water averaging two feet in depth. A small flow of fresh water from an artesian well nearby replenishes water lost from seepage and evaporation. On May 19, the water temperature was 24.5° C.

A small amount of food had been thrown into this pond since the introduction of the shad, April 17 to 25. On May 9, the shad were seen to congregate in the area where food was placed, apparently feeding.

Further observations on May 12 and 19 showed that: (1) within three minutes after food was tossed into the pond, all seventeen shad were in the feeding area eagerly swimming

through the settling food; (2) bits of food were seen to be taken by individual shad with no evidence of subsequent rejection; and (3) after the remaining food had settled to the bottom, the shad were seen to swim back and forth close to the bottom, stirring up mud and food alike in order to get the food before it had resettled—a most curious behavior.

On occasion, these shad have been observed to "fin" in order to take terrestrial insects that have accidentally fallen into the water, but they have not yet been observed to jump for low-flying insects as have the year-old juvenile shad in a neighboring pond. This chance capture of terrestrial insects would be too rare to form a substantial part of the diet of shad.

Although frequently behavior of fish under experimental conditions is quite different from that found in nature, there is some evidence that shad feed while in the rivers to spawn. For example, anglers do take considerable numbers of unspawned shad in the Connecticut River, in the Susquehanna, and in other Atlantic coast streams. Certainly shad must have more than a passive interest in food to take the artificial lures offered by fishermen. The fact that shad will choose individual organisms agrees somewhat with observations of the feeding habits of the closely-related alewives (Bigelow 1926).

Then there is the work on the related Caspian shad (*Caspialosa caspia*), Chajanova (1940), showing that shad feed equally intensively during the pre-spawning, spawning, and post-spawning periods, yet Zamakhaev (1940) found a rapid loss of hypodermic fat during spawning similar to that generally reported in our shad and in other anadromous fishes.

These observations do not explain the absence of food in the stomachs as reported in previous studies. We know that shad are "plankton feeders," characteristically swimming with their gill covers extended straining the water for food. Among the clupeids, Bigelow (1926, p. 101) notes the direct relationship between the fineness of the sieve formed by the gill rakers and the minimum size of the organisms that can be retained and utilized. In the sea the adult shad (i.e. over 40 cm.) feed to a large extent on mysids (Leim 1924) 10 to 30 mm. in length; in fresh water the largest plankton found in abundance are copepods which rarely exceed 5 mm.

¹ The shad investigation of the Fish and Wildlife Service, of which this experiment is a part, is being carried on to furnish information for fishery regulations to the Atlantic States Marine Fisheries Commission.

in length. It seems most likely, then, that the reason for the absence of food in the stomachs of shad in fresh water is that the available food is too small to be collected; we are certain that adult shad are both interested in food and capable of feeding during their stay in fresh water if the proper sized food were present.

SUMMARY

Contrary to previous reports of shad not feeding while in fresh water, mature shad placed in a fresh-water pond at the Fishery Laboratory, Beaufort, N. C., actively fed on ground fish and on a liver - fish meal mix. The shad, which are typically plankton feeders, took the food either as it settled through the water or by swimming back and forth close to the bottom, stirring up mud and food alike and straining out the food before it had resettled. Absence of food in stomachs of shad taken from fresh-water streams is probably attributable to the size of the fresh-water forms, since the available plankton is probably too small to be retained by the gill rakers and utilized for food.

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